Sep 1998

Astoria – East Boat Basin
Breakwater
Sediment Evaluation

(April & June Sampling Events)

Abstract

The Army Corps of Engineers, Portland District personnel, collected 5 core samples and 3 surface grab samples on April 27, 1998. The samples were classified as, fine to very fine-grained sandy silt. The mean grain size of the core samples was 0.24mm and for the surface samples 0.45mm. All samples were submitted for physical and chemical analyses, to include, 9 inorganic metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), and polynuclear aromatic hydrocarbons (PAHs). Three composite samples were analyzed for tributyltin (pore water). The analytical results for total DDT indicated amounts in excess of the screening level (SL). The Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area's Tiered approach requires the next level (III) of sampling (bioassay) to be conducted when SLs are exceeded, if open water disposal are still a consideration. On June 30, 1998 three gravity core samples and 1 box core (reference) sample were taken near the breakwater structure (see Figure 2 in SAP for locations) where DDT was detected in the March sample. These samples were submitted for bioassay analysis as well as ammonia, sulfide, TOC, total DDT, and physical analyses. One sample (A-GC-02) was also submitted for PAHs when a petroleum sheen and odor were detected during sampling. The box core sample was taken at the reference site. These samples were characterized as silt with sand and sandy silt, with a mean grain size of 0.06mm. DDT was not detected above the SL in the second round of samples, however PAHs were detected above the SLs. The analytical results of the bioassay determined this dredge material to be unsuitable for open in-water disposal.

Introduction

The purpose of this report is to characterize the sediment of the Astoria East Boat Basin, based on the sampling events described. Frequent reference will be made to the project Sampling and Analysis Plan (SAP) & the Biological Sampling Addendum attached to this report and listed as a reference. The project description, site history and assessment are detailed in section 1 of the SAP. The sampling and analysis objectives listed below are those stated in the (SAP) (sec. 2.0). This report will outline the procedures used to accomplish these goals.

SAMPLING AND ANALYSIS OBJECTIVES

The sediment characterization program objectives and constraints are summarized below. Additions were made to the original objectives when it was determined that a bioassay would be required.

- To characterize sediments in accordance with the draft regional dredge material testing manual, the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area.

- Collect, handle and analyze representative sediment, surface and core samples, of the purposed dredging prism, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.

- Characterize sediments to be dredged for evaluation of environmental impact.

- Only physical and chemical characterization will be conducted. This was the initial plan; however after DDT was found above the screening level biological testing was added. A second round of sampling took place June 30, 1998.

Historical Data

Sediment sampling was done in the Astoria area in 1980, 1983 and 1990. No samples were taken from the Astoria East Boat Basin. The analyses, from samples collected during these sampling events, indicated Mercury (Hg) to be the only contaminate that exceeds the current established screening levels (SL). Elevated levels of iron (Fe) and manganese (Mn) were also noted.

Current Sampling Events

As mentioned above, the Corps of Engineers, Portland District personnel took 5 core samples and 3 surface grab samples on April 27, 1998. They were submitted for physical and chemical analyses to Sound Analytical Services. Penetration of the corer ranged from 3.3' to 14.0', with core recoveries of 3.1' to 11.3'. The core samples taken were classified as, fine to very fine-grained sandy silt with color bands of dark gray and light gray and contained small amounts of organic material. The 2 longest cores (A-VC-02, 03) were divided into 2 (lower & upper) composite samples each. The other cores and surface samples were treated as individual samples. The three analyses for tributyltin (pore water) were a composite of 2 different sample ID #s combined into one sample composite (02A & 03A = 023A, etc.). All other samples were submitted for physical and chemical analyses, to include, 9 inorganic metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), and polynuclear aromatic hydrocarbons (PAHs). On June 30, 1998 three stations sampled by gravity core and 1 box core sample were taken near the breakwater structure (see Figure 2 for locations) where DDT was detected in excess of the SL. These samples were submitted for bioassay analysis as well as ammonia, sulfide, TOC, total DDT, and physical analyses. One sample (A-GC-02) was also submitted for PAHs when a petroleum sheen and odor were detected in the field sample. The box core sample was taken further from the wall as a reference site for the purposed piling of dredge material from the excavation at this site. The cores ranged from 1.3' to 3.1'. The material was characterized as silt with sand and sandy silt.

Sampling and analysis were performed using proper quality control measures. Proper chain of custody, preservation (4°C.) and cooler receipt was carried out. A ten-percent replicate sample (1) was collected and submitted for analysis. The laboratory reported no quality control issues for the analytical procedures carried out on the sediment sampled in Astoria East Boat Basin for either the April or June event.

Methods/ Discussion for April 27 & June 30, 1998 Sampling Events.

Physical and Total Volatile Solids (TVS): Data for these analyses are presented in Table 1. All of the 10 samples taken April 27 exceeded 20% fines and were submitted for Chemical analysis. Three of the 10 samples exceeded 5% volatile solids. All of the samples were classified as fine to very fine-grained sandy silt. Median grain size for the core samples is 0.08mm, with an average of 29.1 % sand and 69.4 % fines. The median grain size for surface samples is 0.11mm, with an average of 55.6 % sand and 41.8 % fines. The 4 samples taken June 30 exceeded 20% fines, but none exceeded 5% volatile solids. They were classified as silt with sand and sandy silt with an average of 28.3 % sand and 76.8 % fines and a median grain size of 0.05mm.

Metals, Total Organic Carbon (TOC), Tributyltin, Ammonia and Sulfide: Data for these analyses are presented in Table 2. Eleven samples were submitted April 27 for analysis, which includes 1 blind replicate for quality control (QC). The SL was not exceeded for any of the analytes. The level of Hg in 1 sample (A-VC-03B) was at the SL value (0.41 ug/kg). Of the 3 samples analyzed for Tributyltin (TBT), none was detected at the practical quantitation limit (PQL) reported by the laboratory. The 3 samples submitted on June 30 were analyzed for TOC, Ammonia and Sulfide.

Pesticide/PCBs: Data for these analyses are presented in Table 3. Two analyses, for the 11 samples submitted on April 27, exceeded the SL of 6.9ug/kg for total DDT. The 2 samples were from the same core sample (A-VC-02A & 02B). None of the 3 samples submitted on June 30th, for DDT, exceeded the SL. No PCBs were detected in any samples submitted.

Polynuclear Aromatic Hydrocarbons (PAHs): Data for PAHs are presented in Tables 4 & 5. Both low and high density PAHs were detected at very low levels in all of the samples submitted on April 27^{th,} but none approached the SL. The sample submitted on June 30th exceeded 3 SLs for low level PAHs and 3 SLs for high level PAHs.

Bioassay Analyses: Three sediment samples were submitted for bioassay analyses on June 30, 1998. These samples were analyzed following the guidance in the DMEF. The following three tests were run:

1) Amphipod Test – This test involves exposing amphipods (species used - *Ampelisca abdita*) to test sediment for ten (10) days and counting the surviving animals at the end of the exposure period. All 3 biological responses were within the guidelines for suitable material. The amphipod test mortality was less than 30% over reference sediment, which is the acceptable level.

2) Sediment Larval Test – This test monitors larval development of a suitable mollusk (species used – *Mytilus galloprovincialis*) or echinoderm species in the presence of test

sediment. The test is run until the appropriate stage of development is achieved in a sacrificial sea water control. At the end of the test, larva from each test sediment exposure is examined to quantify abnormality and mortality. The seawater control has a performance standard of 30% combined mortality and abnormality (this criteria was met). The reference sediment has a performance standard of 35% combined mortality and abnormality normalized to seawater control (this criteria was met). The test sediment larval normalized combined mortality and abnormality exceeded 30% of the reference and showed statistical significant response relative to the reference sediment. This constitutes a "one-hit failure" (Sec 9.2.4 DMEF) in all 3 of the test sediments.

3) Neanthes Growth test – This test utilizes a polychaete (species used - *Neanthes arenaceodentata*), in a 20-day growth test. The growth rate of organisms exposed to test sediments is compared to the average individual growth rate of organisms exposed to reference sediment. The reference test sediment demonstrated <80% of the negative control growth rate and is statistically significant. This constitutes a "one-hit failure".

As a result of the "one hit-failure" in the Larval test and the Neanthes Growth test the material represented by these samples is considered unacceptable for open water disposal under Tier III of the DMEF.

Conclusion

All metals were found below the SL, with the exception of Hg in one sample (A-VC-03B), it was found at the SL value of 0.41 ug/kg. This sample was a composite of the lower 77 inches of a 121 inch long core taken at the West End of the dredging prism, inside (south side) of the East End of the breakwater structure (see map, Figure 1). The only chemical to exceed the SL value, for those samples submitted on April 27, was the chlorinated pesticide DDT and its breakdown components of DDD and DDE. The total DDT found above the 6.9ug/kg SL was in sample A-VC-02A & 02B. This core sample was taken inside (south side) of the breakwater structure just east of the angle change in the breakwater structure (East End) (see map Figure 1). The "A" sample is a composite from the surface to 48 inches in depth, with DDT detected at 9.69 ug/kg. The "B" sample represents the lower depth, from 48 inches down to the core depth of 130 inches, with DDT detection of 7.0 ug/kg. As a result of the total DDT found in this core sample, in excess of the SL, the DMEF criteria requires that Tier III level bioassay analyses be conducted. The 2nd sampling event was conducted on June 30th; to collect sediment in the vicinity of the DDT found above SL. In the field, during the collection of these samples, petroleum sheen and odor was detected in sample A-GC-02. It was determined that this sample should also be submitted for PAHs in addition to DDT and the bioassay tests. PAHs were found in this sample above SLs in both low and high density PAHs. DDT was not found in any of the (June 30th) samples, above the SL. The bioassay results (see discussion for more information) indicated that the material to be dredged is not suitable for open in-water disposal.

References

1. Percy, K.L., Bella, D.A., Sutterlin, C., Klingeman, P.C. 1974. Descriptions and information Sources for Oregon Estuaries. Sea Grant College Program, Oregon State University.

2. Navigation Branch, Operations Division, U. S. Army Corps of Engineers, Portland District. September 1991. Federal Navigation Projects: Columbia River Maintenance Disposal Plan. (Prepared by Mandaville Associates, 600 S. W. Tenth #418, Portland, Oregon 92205)

3. U.S. army Corps of Engineers, Portland District, Seattle District, U.S. Environmental Protection Agency, Region 10, Oregon Department of Environmental Quality, Washington State Department of Natural Resources. April 1998 (draft document). Dredge Material Evaluation Framework Lower Columbia River.

4. Department of Environmental Quality. March 1998. Portland Harbor Sediment Study, Lower Willamette River – Raw Data set, 1997-98 Joint DEQ/EPA Investigation. Portland, Oregon.

5. U.S. army Corps of Engineers, Portland District. 1987. Astoria Deep Draft Summary of Existing Data, Portland, Oregon.

Table 1, Astoria - East Boat Basin

Physical Analysis

Sampled April 27,1998
June 30, 1998

27-Apr-98 Sample I.D.		Grain Size (mm) Median		Mean		% Sand	Silt/Clay	Volatile solids
A-PG-01	Surface sample	0.12		0.92		53.6	38.7	6.7
A-PG-02	Surface sample	0.14		0.14		64.8	35.2	2.7
A-PG-03	Surface sample	0.06		0.28		48.4	51.5	2.4
Average		0.11		0.45		55.6	41.8	3.9
Maximum		0.14		0.92		64.8	51.5	6.7
A-VC-01	Core Sample	0.20	(rock)	1.34		55.8	33.3	5.2
A-VC-02A	Core Sample	0.14		0.05		30.6	69.4	2.6
A-VC-02B	Core Sample	0.04		0.05		23.9	76.1	3.8
A-VC-02B	(duplicate)	0.03		0.04		23.7	76.3	N/A
A-VC-03A	Core Sample	0.05		0.05		27.3	72.5	2.5
A-VC-03B	Core Sample	0.04		0.07		27.4	72.2	4.3
A-VC-04	Core Sample	0.04		0.06		20.3	79.5	5.3
A-VC-05	Core Sample	0.04		0.04		23.9	76.1	4.8
Average		0.08		0.24		29.1	69.4	4.1
Maximum		0.20		1.34		55.8	79.5	5.3
30-Jun-98								
A-GC-01	Gravity Core	0.04		0.04		23.7	76.3	2.2
A-GC-02	Gravity Core	0.05		0.08		30.7	68.7	2.6
A-GC-03	Gravity Core	0.04		0.03		23.2	76.8	2.5
A-BC-04R	Box Core	0.05		0.08		35.8	64.3	3.6
A-BC-04R	Duplicate	0.05		0.08		35.3	64.7	3.5
Average		0.05		0.06		28.3	71.5	2.7
Maximum		0.05		0.08		35.8	76.8	3.6

N/A = Not Available

Table 2, Astoria East Boat Basin

Inorganic Metals, Organotin and TOC

Sampled April 27, 1998

Sample I.D.	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	TOC
27-Apr-98	mg/kg (ppm)									
A-PG-01	7.8	0.57	14	51	15	< 0.13	14	< 3.3	110	21000
A-PG-02	3.3	< 0.25	10	14	10	< 0.13	7.1	< 3.3	62	5900
A-PG-03	5.1	< 0.25	11	21	13	< 0.13	8.2	< 3.3	71	8700
A-VC-01	5.9	0.28	13	23	18	< 0.13	14	< 3.3	87	8000
A-VC-02A	3.3	0.31	13	27	17	0.13	8.5	< 3.3	88	5400
A-VC-02B	5.6	1.2	23	23	21	0.21	12	< 3.3	120	10000
A-VC-03A	3	0.29	11	20	11	< 0.13	8.8	< 3.3	72	5300
A-VC-03AA	N/A	N/A	7.5	28	N/A	< 0.13	3	< 3.3	55	6100
A-VC-03B	6.8	2	32	29	30	0.41	13	< 3.3	150	12000
A-VC-04	5.1	0.42	21	35	21	< 0.13	14	< 3.3	81	13000
A-VC-05	6.6	0.72	17	28	28	< 0.13	11	< 3.3	110	9900
Screening level (SL)	57	5.1	*	390	450	0.41	140	6.1	410	
Maximum	7.8	2	32	51	30	0.41	14	< 3.3	150	
Mean	4.8	5.3	15.7	27.2	16.7	0.07	10.3	< 3.3	91.5	
Sample I.D.	**TBT (pore water) ug/kg (ppb)**									
A-VC-023A		<0.01								
A-VC-023B		<0.01								
A-VC-045		<0.01								
Screening level:		0.15								
30-Jun-98						**Sulfide mg/kg**		**Ammonia mg/kg**		**TOC**
A-GC-01**						50		180		5200
A-GC-02**						21		130		6100
A-GC-03**						15		160		6600
A-BC-04R**						<5		160		9500

(<) = Non-detect at reporting limit N/A = Not Available * Screening Level not establishe ** Not Analyzed for metals

Table 3, Astoria East Boat Basin

Pesticides/PCBs

Sampled April 27, 1998

Sample I.D.	PCB	Pesticides - organochlorine analytes detected								
	ug/kg (ppb)	ug/kg (ppb)								
	7 Arochlor	Aldrin	Linda	Dieldrin	Endrin	Beta-BHC	4,4'-DDE	4,4'-DDD	4,4'-DDT	Heptachlor
A-PG-01	<.37	<.37	<.37	<.74	<.74	<.33	**3.3**	**1.3**	<.74	<.28
A-PG-02	<.37	<.37	<.37	<.74	<.74	<.33	<.74	<.74	<.74	<.28
A-PG-03	<.37	**1.9**	**1.6**	**4.1**	**3.4**	<.33	**0.9**	<.74	**2.4**	**3.2**
A-VC-01	<.37	<.37	<.37	<.74	<.74	<.33	<.74	<.74	<.74	<.28
A-VC-02A	<.37	<.37	<.37	<.74	<.74	<.33	**0.79**	**2.4**	**6.5**	<.28
A-VC-02B	<.37	<.37	<.37	<.74	<.74	<.33	**1.4**	**5.6**	<.74	<.28
A-VC-03A	<.37	<.37	<.37	<.74	<.74	<.33	**0.58**	**1.5**	**3.3**	<.28
A-VC-03AA	<.37	<.37	<.37	<.74	<.74	<.33	**0.64**	**1.0**	<.74	<.28
A-VC-03B	<.37	<.37	<.37	<.74	<.74	<.33	**1.2**	**4.7**	<.74	<.28
A-VC-04	<.37	<.37	<.37	<.74	<.74	**1.1**	<.74	<.74	<.74	<.28
A-VC-05	<.37	<.37	<.37	<.74	<.74	**1.3**	**0.84**	**3.0**	**0.79**	<.28
Screening level (SL	130	10	10	10	*	*	{	6.9	}	10
Mean		0.17	0.15	0.37	0.31	0.22	0.88	1.77	1.18	0.29
Maximum		1.9	1.6	4.1	3.4	1.3	1.4	5.6	6.5	3.2

30-Jun-98		4,4'-DDE	4,4'-DDD	4,4'-DDT
A-GC-01**	Gravity Core	<0.24	<0.51	<1.8
A-GC-02**	Gravity Core	4.7	<0.51	<1.7
A-GC-03**	Gravity Core	<0.26	<0.54	<1.9
A-BC-04R**	Box Core	<0.26	<0.54	<1.9
Mean		1.2	<0.52	<1.8
Maximum		4.7	<0.54	<1.9

* Screening Level not established

(<) = Non-detect at reporting limit

Shaded area values exceed SL

** Only analyzed for DDT

Table 4, Astoria East Boat Basin

Polynuclear Aromatic Hydrocarbons (PAHs)

Sampled April 27, 1998
June 30, 1998

Low Molecular Weight Analytes

Sample I.D.	Sample Date	Acenapththene	Acenaphthylene	Anthracene	Fluorene
A-PG-01	27-Apr-98	<1.9	<1.9	4.3	3.5
A-PG-02	27-Apr-98	<1.3	<1.3	<1.3	<2.6
A-PG-03	27-Apr-98	27.0	<1.4	2	3.3
A-VC-01	27-Apr-98	<1.5	<1.5	2.3	1.5
A-VC-02A	27-Apr-98	5.1	1.7	7.6	13
A-VC-02B	27-Apr-98	1.9	4.2	8.9	4.2
A-VC-03A	27-Apr-98	2.1	1.6	2.8	3.7
A-VC-03AA	27-Apr-98	2.2	<1.5	3.8	2.5
A-VC-03B	27-Apr-98	<1.7	4.8	4.1	3.5
A-VC-04	27-Apr-98	1.6	5.5	5.4	3.6
A-VC-05	27-Apr-98	1.9	5.6	5.2	3.4
Screening level		500	560	960	540
Mean	27-Apr-98	3.8	2.1	4.2	3.8
Maximum	27-Apr-98	27	5.6	8.9	13
A-GC-02*	30-Jun-98	495	195	**1450**	**890**

Sample I.D.	Sample Date	2-Methylnapthalene	Naphthalene	Phenanthrene	Total Low PAHs
A-PG-01	27-Apr-98	<3.7	2.6	11	21.4
A-PG-02	27-Apr-98	<3.7	<2.6	2.6	2.6
A-PG-03	27-Apr-98	<2.8	<1.4	28	31.8
A-VC-01	27-Apr-98	<2.9	<1.5	5.7	9.5
A-VC-02A	27-Apr-98	<3.0	3.9	27	58.3
A-VC-02B	27-Apr-98	2.7	9.7	28	59.6
A-VC-03A	27-Apr-98	<2.9	3.8	18	32
A-VC-03AA	27-Apr-98	<2.9	3.4	18	29.9
A-VC-03B	27-Apr-98	2.7	<1.7	17	32.1
A-VC-04	27-Apr-98	2.1	12	21	51.2
A-VC-05	27-Apr-98	2.6	11	21	50.8
Screening level		670	2100	1500	29000
Mean	27-Apr-98	0.9	4.2	17.9	34.5
Maximum	27-Apr-98	2.7	12	28	59.6
A-GC-02*	30-Jun-98	39	65	5300	8434

(<) = Non-detect at reporting limit. * Average of two analyses.

Table 5, Astoria East Boat Basin

Polynuclear Aromatic Hydrocarbons (PAHs)

High Molecular Weight Analytes

Sampled: April 27, 1998
June 30, 1998

Sample I.D.	Sample Date	Benz(a)anthracene	Benzo(b)fluroanthene	Benzo(k)fluroanthene	Benzo(g,h,i)perylene	Chrysene	Pyrene
A-PG-01	27-Apr-98	8.7	7.4	5.7	5.7	9.1	35
A-PG-02	27-Apr-98	3.4	4.1	1.6	3.7	3.8	6.9
A-PG-03	27-Apr-98	10	11	4.3	6.4	15	83
A-VC-01	27-Apr-98	8.3	12	4.4	5.3	9.4	20
A-VC-02A	27-Apr-98	13	22	8.6	12	17	44
A-VC-02B	27-Apr-98	17	30	14	28	24	63
A-VC-03A	27-Apr-98	8.4	19	6.3	9.8	17	30
A-VC-03AA	27-Apr-98	15	19	6.4	12	17	36
A-VC-03B	27-Apr-98	19	27	15	26	22	45
A-VC-04	27-Apr-98	13	17	9.5	14	22	38
A-VC-05	27-Apr-98	17	23	9.1	22	21	45
Screening level		1300	3200	No (SL) established	670	1400	2600
Mean	27-Apr-98	12.1	17.4	7.7	13.1	16.1	40.5
Maximum	27-Apr-98	19	30	15	28	24	83
A-GC-02*	30-Jun-98	**1700**	1050	305	485	**1750**	**4500**

Sample I.D.	Sample Date	Benzo(a)pyrene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	Fluoranthene	Total High PAH
A-PG-01	27-Apr-98	9.8	<1.9	<1.9	52	133.1
A-PG-02	27-Apr-98	3.7	<1.3	1.9	6.6	35.2
A-PG-03	27-Apr-98	11	<1.4	<1.4	35	175.7
A-VC-01	27-Apr-98	8.3	<1.5	5.1	30	102.8
A-VC-02A	27-Apr-98	16	<1.5	11	100	243.6
A-VC-02B	27-Apr-98	31	2.2	24	93	326.2
A-VC-03A	27-Apr-98	15	<1.5	10	59	174.5
A-VC-03AA	27-Apr-98	17	<1.5	12	76	210.4
A-VC-03B	27-Apr-98	35	<1.7	27	66	260
A-VC-04	27-Apr-98	18	<1.6	12	42	265.5
A-VC-05	27-Apr-98	27	<1.5	19	63	246.1
Screening level		1600	230	600	1700	12000
Mean	27-Apr-98	17.4	0.2	5.1	56.6	2173.1
Maximum	27-Apr-98	35	2.2	27	100	197.6
A-GC-02*	30-Jun-98	1400	11	385	**2800**	**14386**

(<) = Non-detect at reporting limit.

Table 6, Astoria East Boat Basin

Bioassay

Sampled June 30, 1998

Treatment	Amphipod Test	Sediment Larval Test	Neanthes Growth Test	Suitability
	(% mortality)	(% NCMA)	(mg/individual-day) (% of reference)	
Negative control	10 7.9	0.0 12.1	0.63 0.15 0.0% mortality	
A-BC-04R (reference)	13 5.7	6.2 7.5	0.38 0.11	Unsuitable
A-GC-01	15 5.0	63.9 10.4	0.33 0.06 (86%)	Unsuitable
A-GC-02	10 3.5	69.1 5.9	0.45 0.09 (121%)	Unsuitable
A-GC-03	13 5.7	55.1 10.2	0.38 0.04 (100%)	Unsuitable

Shaded area indicates failured results (see page 3 for discussion and 9.2.4 DMEF for criteria).

Figure 1, Port of Astoria, East Boat Basin, Breakwater Repair Project

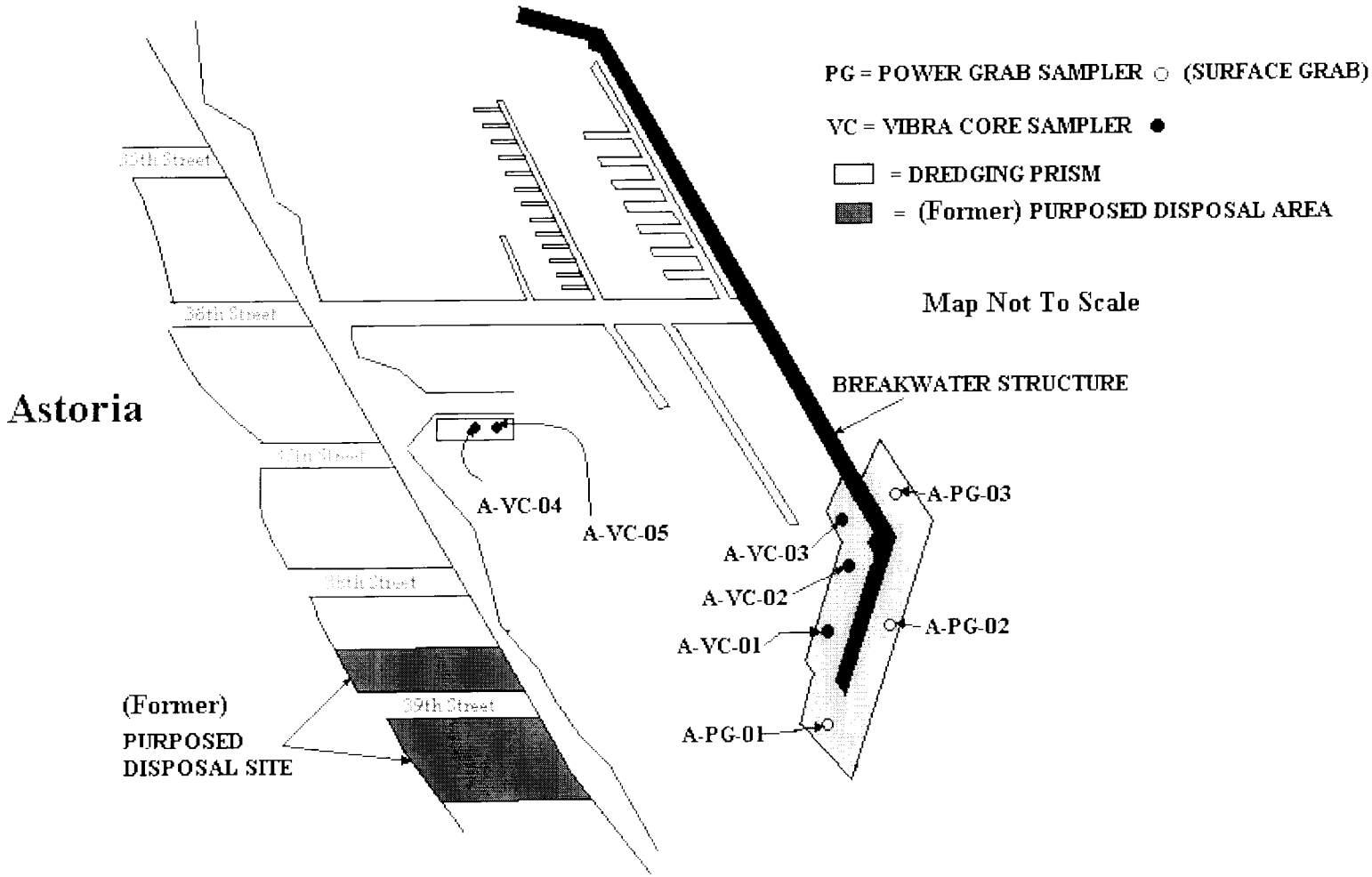
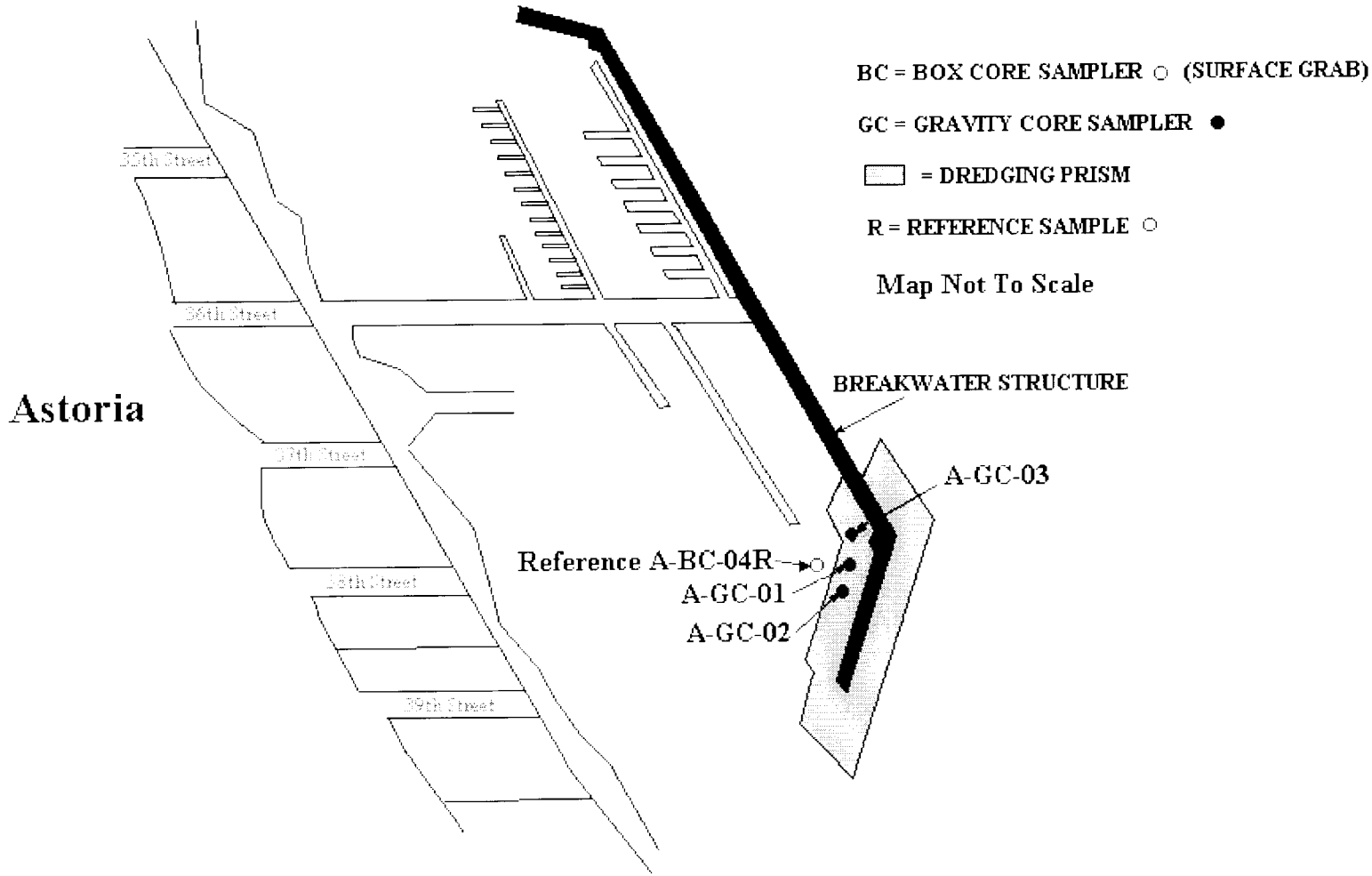


Figure 2, Port of Astoria, East Boat Basin, Breakwater Repair Project
Bioassay Samples & Reference Sample



SEDIMENT
SAMPLING & ANALYSIS PLAN
FOR THE
PORT OF ASTORIA
EAST BOAT BASIN
NORTH BREAKWATER REPAIR

April & June 1998

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1.0 PROJECT DESCRIPTION, SITE HISTORY AND ASSESSMENT

1.1 Project Site Description and Location: The project is located at the Port of Astoria, East Mooring Basin, Columbia River, Clatsop County, Astoria, Oregon. Repair/replacement is to be done on the east boat basin north breakwater structure. Dredging is to take place at the base of the east end of the structure and also in an area, approximately 500'x 100'x 8', on the east side of the boat ramp. Purposed disposal of the dredge material is to be upland, in an area adjacent to 39th street. Sediment sampling will be done on both sides of the structure section to be repaired/replaced and on the east side of the boat ramp. Three vibra core samples will be taken on the southwest side of the breakwater structure and up to 2 vibra core samples in the area east of the boat ramp. These vibra cores will be divided into four foot sections, starting at the surface down, and submitted for chemical and physical analysis. Three surface samples will be taken, two on the northeast side of the breakwater structure, the third off the east end of the structure. The surface samples will be submitted for physical analysis only, unless they consist of greater than 20% fines. If greater than 20% fines samples will be submitted for chemical analyses also.

1.2 Site History: In January 1994 permit maintenance dredging took place within the breakwater area to maintain adequate depth for commercial fishing vessels. Prior to dredging sediment quality samples were taken and submitted for analysis and the material found suitable for inwater disposal.

1.3 Previous Sediment Sampling: Four sediment samples were taken December 7, 1993 at the Port of Astoria East Mooring Basin (PAEMB) and tested for metals, pesticides, polychlorinated biphenols (PCBs) and polynuclear aromatic hydrocarbons (PAHs). All the samples showed low levels for 2 or more PAHS. All the samples contained some of the butyltin (by bulk analysis) compounds. All samples contained metals at low levels except for the number 1 sample which had several metals (As, Pb, Cu) at higher levels. This sample was taken outside of the area to be dredged, however. All samples taken from the area to be dredged were well below the screening levels established in the Dredge Material Evaluation Framework for the Lower Columbia River (EFLCR) manual.

2.0 SAMPLING AND ANALYSIS OBJECTIVES

- To characterize sediments in accordance with the draft Evaluation Framework for the Lower Columbia River (EFLCR) manual.
- Collect, handle and analyze representative sediment, surface and core samples of the proposed dredging prism in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.
- Characterize sediments to be dredged for evaluation of environmental impact.
- Only physical and chemical characterization will be conducted.

3.0 SAMPLING AND ANALYSIS REQUIREMENTS

3.1 Project Ranking: While this area has not been ranked under the EFLCR; it would most likely fall into the moderate ranking or lower, based on data received form past sampling. The 5 core samples and 3 grab samples will be adequate sampling for the estimated 22,000 cy of material to be dredged.

3.2 Sampling and Analysis Requirements: Material to be dredged from the PAEMB will be sampled using a vibra core sampling devise and a power grab, surface sampler. An vibra coring system collects a continuous profile of sediments below the mudline. A power grab sampler is a clamshell, surface sampler. All samples will be subjected to physical analyses. All vibra core samples will be subject to both physical and chemical

analyses. From the 5 cores and 3 surface samples, 11 physical and 14 chemical analyses will be conducted. Ten percent (1 samples) will be Quality Control blind replicate samples, submitted for chemical analysis only.

4.0 SAMPLE COLLECTION AND HANDLING PROCEDURES

4.1 Sampling Locations and Numbering: Figure 1 shows the project area and sample locations. Sampling sites are located for the best characterization of the material within the dredging prism as possible. Proper QA/QC procedures as outlined in this section will be followed. Any deviation from these procedures shall be noted in the field log. Sample identification shall follow the following convention:

A-XX-YY (Z)

Where, A denotes samples collected from Astoria, "XX" denotes the type of sampling device such as VC - vibra corer, PG-Power grab; "YY" denotes the numeric sample number and will consist of two digits for all samples (i.e. 01, 05, 15, etc.). For cores an alpha character (i.e. A, B, C, etc.) will be used to denote vertical location as represented here by "Z". The core will be sampled in sections starting from the surface to 4-foot depth and each subsequent 4-foot depth (or partial 4-foot depth). The surface section will be labeled A- XX-YYA, the second section CS-XX-YYB, etc. Surface grab samples will have no alpha character. The QC replicates will have the same sample number as the primary sample, with an additional "A" added (CS-GC-YY-AA). Composite samples will have a combined number in the "YY" designation (i.e. sample 02 & 03 = 023, etc.).

4.2 Field Sampling Schedule: Sampling is planned for April 27, 1998.

4.3 Field Notes: Field notes will be maintained during sampling and compositing operations. Included in the field notes will be the following:

- Names of the person(s) collecting and logging in the samples.
- Weather conditions.
- Depth of each station sampled as measured from the water surface. This will be accomplished using a leadline or corrected depth recorder.
- Date and time of collection of each sediment sample.
- The sample station number and individual designation numbers assigned for each individual sample.
- Descriptions of sediment or core sections.
- For cores the length of core and the penetration depth of the sampling device.
- Any deviation from the approved sampling plan.

4.4 Positioning: Sampling locations will be recorded in the field. Horizontal coordinates will be referenced to the Washington Coordinate System for proper North or South Zones NAD 27 (North American Datum 1927). Horizontal coordinates will be identified as latitude and longitude to the nearest 0.1 second.

4.5 Decontamination: All sampling devices and utensils will be thoroughly cleaned prior to use according to the following procedure:

- Wash with brush and Alconox soap
- Rinse with distilled water
- Rinse with 10% nitric acid solution
- Rinse with distilled water

Utensils used to collect physical samples only or sampling devices such as the power grab sampler will be washed down before each sampling event. However, they will not require the cleaning procedure listed above as long as samples collected for chemical analyses are not in contact with the core walls. All utensils used to collect chemical samples will require decontamination prior to each use. All hand work for chemical analyses will be conducted with disposable latex gloves which will be rinsed with distilled water before and after handling each individual sample, as appropriate, to prevent sample contamination. Gloves will be disposed of between samples or composites to prevent cross contamination between samples.

4.6 Core Logging: Each discrete core section will be inspected and described. For each core sample, the following data will be recorded on the core log:

- Depth interval of each core section as measured from Columbia River Datum.
- Sample recovery
- Physical soil description in accordance with the Unified Soil Classification System (includes soil type, density/consistency of soil, color)
- Odor (e.g., hydrogen sulfide, petroleum products)
- Visual stratification and lenses
- Vegetation
- Debris
- Biological Activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Any other distinguishing characteristics or features

4.7 Field Replicates: Blind field replicates will be prepared and submitted along with the rest of the samples to the laboratory. This represents about 10% of the total samples collected. Sample numbers shall be labeled the same as the primary sample with the last letter duplicated i.e. A-XX-YYA (primary), A-XX-YYAA (replicate). Replicate sample locations shall be documented in the field log.

4.9 Sample Transport and Chain-of-Custody Procedures: After sample containers have been filled they will be packed on iced in coolers. Chain-of-custody procedures will commence in the field and will track delivery of the samples. Sample holding times and storage requirements are presented in Table 1. Specific procedures are as follows:

- Samples will be packaged and shipped in accordance with U.S. Department of Transportation regulations as specified in 49 CFR 173.6 and 49 CFR 173.24 or delivered directly to the testing laboratory.
- Individual sample containers will be packed to prevent breakage.
- The coolers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the cooler and office name and address) to enable positive identification.
- A sealed envelope containing chain-of-custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.

Upon transfer of sample possession to the laboratory, the persons transferring custody of the coolers will sign the chain-of-custody form. Upon receipt of samples at the laboratory, the coolers will be inspected and the receiver will record the condition of the samples.

Table 1, Sample Volume and Storage

Sample Type	Holding Time	Sample Size (a)	Temperature (b)	Container	Archive (c)
Particle Size	6 Months	200 g	4°C	1-1 Quart Plastic Bag	
Total Solids	14 Days	125 g	4°C	1-Liter Glass (combined)	X
Total Volatile Solids	14 Days	125 g	4°C		
Total Organic Carbon	14 Days	125 g	4°C		
Mercury	28 Days	5g	4°C		
Metals (except Mercury)	6 Months	50 g	4°C		
Pesticides and PCBs	14 Days	10 g	4°C		
Butyltin (pore water)	14 Days	4 liters (for extraction)	4°C	4-Liter Glass	

a. Required sample sizes for one laboratory analysis. Actual volumes to be collected have been increased to provide a margin of error and allow for retest.
b. During transport to the lab, samples will be stored on blue ice.
c. A minimum 250-ml container is filled and frozen to run any or all of the analyses indicated.

5.0 LABORATORY PHYSICAL AND CHEMICAL SEDIMENT ANALYSIS

5.1 Laboratory Analyses Protocols. Laboratory testing procedures will be conducted in accordance with the EFLCR. The samples will be analyzed for all the parameters listed in sections 5.1.3 and 5.1.4 as requested on the chain-of-custody record. Private contract analytical chemical laboratories will conduct all physical and chemical analyses.

5.1.1 Chain-of-Custody: A chain-of-custody record for each set of samples will be maintained throughout all sampling activities and will accompany samples and shipment to the laboratory. Information tracked by the chain-of-custody records in the laboratory include sample identification number, date and time of sample receipt, analytical parameters required, location and conditions of storage, date and time of removal from and return to storage, signature of person removing and returning the sample, reason for removing from storage, and final disposition of the sample.

5.1.2 Limits of Detection: Detection limits of all chemicals of concern must be below screening levels. All reasonable means, including additional cleanup steps and method modifications, will be used to bring all limits-of-detection below the screening levels. In addition, an aliquot of each sediment sample for analysis will be archived and preserved at -18 C for additional analysis if necessary. Sediments or extracts will be kept under proper storage conditions until the chemistry data is deemed acceptable.

5.1.3 Sediment Chemistry: Private analytical laboratories will conduct all chemical analyses. Chemical analyses will include: metals (6010/7000 or 6020 series), total organic carbon (TOC) method 9060, polynuclear aromatic hydrocarbons (PAHs) 8270 SIM method or other low level detection method, pesticides/PCBs by 8081 and Butyltin (TBT) compounds, by pore water method.

5.1.4 Sediment Conventionals: The private analytical laboratories will analyze physical parameters. Particle grain size distribution for each sample will be determined. Sieve analysis will use a geological sieve series, which will include the sieve sizes U.S. NO. 5, 10, 18, 35, 60, 120, and 230. Hydrogen peroxide will not be used in preparations for grain-size analysis. Hydrometer analysis will use for particle sizes finer than the 230 mesh. Water content will be determined using ASTM D 2216. Sediment classification designation will be made in accordance with U.S. Soil Classification System, ASTM D 2487.

5.1.5 Holding Times: To the maximum extent practicable all chemical results will be provided within 30 days of receipt. All samples for physical and chemical testing will be maintained at the testing laboratory at the temperatures specified in Table 1 and analyzed within the holding times shown in the table.

5.1.6 Quality Assurance/Quality Control: The chemistry QA/QC procedures found in Table 2 will be followed.

5.2 Laboratory Written Report: The analytical laboratory documenting all the activities associated with sample analyses will prepare a written report. As a minimum, the following will be included in the report:

- Results of the laboratory analyses and QA/QC results.
- All protocols used during analyses.
- Chain of custody procedures, including explanation of any deviation from those identified herein.
- Any protocol deviations from the approved sampling plan.
- Location and availability of data.

As appropriate, this sampling plan may be referenced in describing protocols.

Table 2, Minimum Laboratory QA/QC

Analytical Type	Method Blank[2]	Duplicate[2]	RM[2,4]	Matrix Spikes[2]	Surrogates[7]
Semivolatiles[1]	X	X[3]	X[5]	X	X
Pesticides/PCBs[1]	X	X[3]	X[5]	X	X
Metals	X	X	X[6]	X	
Total Organic Carbon	X	X	X[6]		
Total Solids		X			
Total Volatile Solids		X			
Particle Size		X			

1. Initial calibration required before any samples are analyzed, after each major disruption of equipment, and when ongoing calibration fails to meet criteria. Ongoing calibration required at the beginning of each work shift, every 10-12 samples or every 12 hours (whichever is more frequent), and at the end of each shift.

2. Frequency of Analysis = one per batch
3. Matrix spike duplicate will be run
4. Reference Material
5. Canadian standard SRM-1
6. NIST certified reference material 2704
7. Surrogate spikes will be included with every sample, including matrix-spiked samples, blanks and reference materials

6.0 BIOLOGICAL TESTING

6.1 Biological Testing: No biological testing will be conducted under this study, however the need for biological testing will be assessed per the EFLCR.

7.0 REPORTING

7.1 QA Report: The laboratory QA/QC reports will be incorporated by reference. This report will identify any laboratory activities that deviated from the approved protocols and will make a statement regarding the overall validity of the data collected.

7.2 Sediment Evaluation Report: A written discussion of findings shall be prepared documenting the physical and chemical character of potential material to be dredged. The physical and chemical reports will be included as reference; individual copies will be furnished as requested. As a minimum, the following will be included in the

- Previous sampling and analyses.
- Locations where the sediment samples were collected.
- A plan view of the project showing the actual sampling location.
- Description of sampling.
- Chemical testing data, with comparisons to screening levels guidelines.

APPENDIX A

PARAMETERS AND METHODS

1. Recommended Sample Preparation Methods, Cleanup Methods, Analytical Methods and Detection Limits for Sediment Management Standards, Chapter 173-204 WAC, Draft - July 1996.

2. Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound, Puget Sound Estuary Program, March 1986.

3. Recommended Methods for Measuring TOC in Sediments, Kathryn Bragdon-Cook, Clarification Paper, Puget Sound Dredged Disposal Analysis Annual Review, May, 1993.

4. Units: ug = microgram, mg = milligram, kg = kilogram, dw = dry weight, oc = organic carbon.

5. Test Methods for Evaluating Solid Waste. Laboratory manual physical/chemical methods. Method 3050, SW-846, 3rd ed., Vol. 1A, Chapter 3, Sec 3.2, Rev 1. Office of Solid Waste and Emergency Response, Washington, DC.

6. Graphite Furnace Atomic Absorption (GFAA) Spectrometry - SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

7. Inductively Coupled Plasma (ICP) Emission Spectrometry - SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

8. Test Methods for Evaluating Solid Waste. Laboratory manual physical/chemical methods. Method 7471, SW-846, 3rd ed., Vol. 1A, Chapter 3, Sec 3.3. Office of Solid Waste and Emergency Response, Washington, DC.

9. Sonication Extraction of Sample Solids - Method 3550 (Modified), SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986. Method is modified to add matrix spikes before the dehydration step rather than after the dehydration step.

10. GCMS Capillary Column - Method 8270, SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

11. Purge and Trap Extraction and GCMS Analysis - Method 8260, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

12. Soxhlet Extraction and Method 8081, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

13. Total PCBs BT value in mg/kg oc.

QA2 DATA REQUIREMENTS

CHEMICAL VARIABLES

ORGANIC COMPOUNDS

The following documentation is needed for organic compounds:

A cover letter referencing or describing the procedure used and discussing any analytical problems

Reconstructed ion chromatograms for GC/MS analyses for each sample

Mass spectra of detected target compounds (GC/MS) for each sample and associated library spectra

GC/ECD and/or GC/flame ionization detection chromatograms for each sample

Raw data quantification reports for each sample

A calibration data summary reporting calibration range used [and decafluorotriphenylphosphine (DFTPP) and bromofluorobenzene (BFB) spectra and quantification report for GC/MS analyses]

Final dilution volumes, sample size, wet-to-dry ratios, and instrument detection limit

Analyte concentrations with reporting units identified (to two significant figures unless otherwise justified)

Quantification of all analytes in method blanks (ng/sample)

Method blanks associated with each sample

Recovery assessments and a replicate sample summary (laboratories should report all surrogate spike recovery data for each sample; a statement of the range of recoveries should be included in reports using these data)

Data qualification codes and their definitions.

METALS

For metals, the data report package for analyses of each sample should include the following:

Tabulated results in units as specified for each matrix in the analytical protocols, validated and signed in original by the laboratory manager

Any data qualifications and explanation for any variance from the analytical protocols

Results for all of the QA/QC checks initiated by the laboratory

Tabulation of instrument and method detection limits.

All contract laboratories are required to submit metals results that are supported by sufficient backup data and quality assurance results to enable independent QA reviewers to conclusively determine the quality of the data. The laboratories should be able to supply legible photocopies of original data sheets with sufficient information to unequivocally identify:

Calibration results

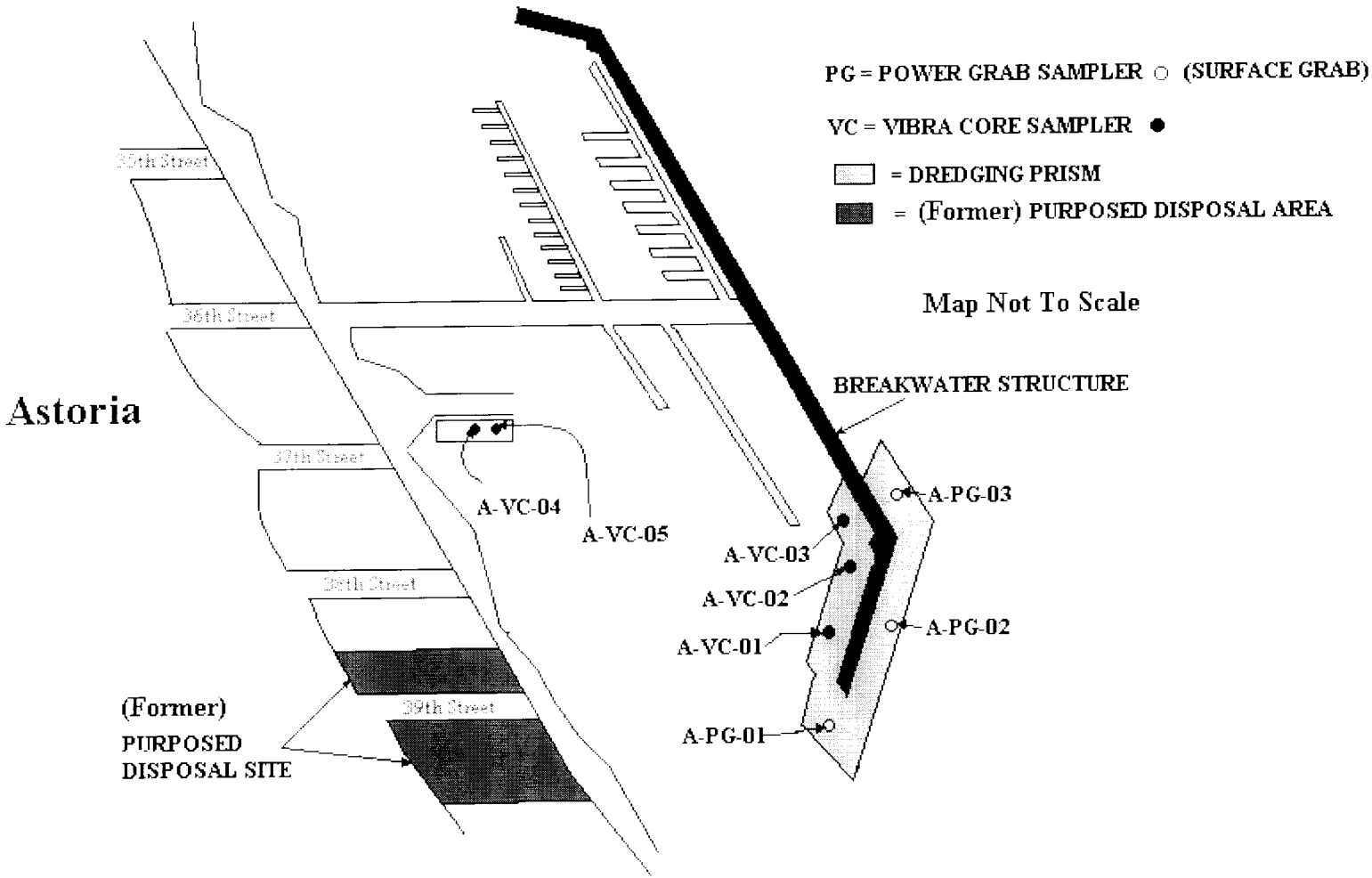
Calibration and preparation blanks

Samples and dilutions

Duplicates and spikes

Any anomalies in instrument performance or unusual instrumental adjustments.

Figure 1, Port of Astoria, East Boat Basin, Breakwater Repair Project



Biological Testing Addendum – Astoria EBB

This addendum will supplement the Sampling and Analysis Plan used for the April physical and chemical sampling and analysis at Astoria East Boat Basin.

6.0 Biological Testing

Chemical data generated from the Astoria (April 27, 1998) sampling event exceeded the screening level (SL) of 6.9 ug/kg, for total DDT at sampling station A-VC-02, in 2 composite samples (9.69 & 7.0 ug/kg). As set forth in the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area, Tier III biological testing is being initiated. Three gravity core samples will be taken in the vicinity of the A- VC-02 sample location (see map, Figure 1) that contained DDT above the SL.

In order to place new sheet piling adjacent to the old piling, dredging of the sediment and toe rock, within approximately 30 feet of the structure, must take place. The dredged sediment will be dredged using a clam shell dredge, which will swing in an arch and place the sediment inwater adjacent to the dredge site (30-60 feet from structure). After repair/construction has been made to the breakwater structure and the toe rock replaced, the dredge sediment will be placed on top of the toe rock.

6.1 Bioassay Laboratory Protocols. Bioassay testing requires that test sediments be matched and run with appropriate approved reference sediment to factor out sediment grain-size effects on bioassay organisms.

Selection of appropriate reference sediment will be made as stipulated in the DMEF and approved by EPA and DEQ. The reference site sample will be collected from the area where the dredge sediment will be placed inwater before it is returned to its original position on top of the toe rock at the base of the breakwater structure.

6.2 General Biological Testing Procedures.

- Physical analysis for grain size and chemical analysis for DDT, total solids, total volatile solids, total organic carbon, bulk sulfides ammonia and other analysis, if deemed necessary in the field, will be run in conjunction with the biological testing. The same convention will be used to number, log, collect and decontaminate while collecting samples, as described in the original sampling and analysis plan.

- Five laboratory replicates of test sediments, reference sediments and negative controls will be run for each bioassay.
- Cadmium chloride will be used as a reference toxicant for all three bioassays, using standardized concentrations specified by PSDDA.
- For the *Neanthes* and amphipod bioassays, sacrificial beakers will be used to determine interstitial salinity, ammonia and sulfides for all test and reference sediments at the beginning and end of the test period. Overlying ammonia and sulfides will be determined at test initiation and termination for the larval test.
- Water quality monitoring will be conducted, consisting of daily measurements of salinity, temperature, pH and dissolved oxygen for the amphipod and sediment larval bioassays and measurements every three days for the *Neanthes* test. Monitoring will be conducted for all test and reference sediments and negative controls (including seawater controls). Parameter measurements must be within the limits specified for each bioassay. Measurements for each treatment will be made on a separate chemistry beaker set up identically to the other replicates within the treatment group, including the addition of test organisms.

6.3 Bioassay-specific Procedures.

6.3.1 Amphipod Bioassay. Data to be reported for this bioassay include survival, daily emergence and the number of amphipods failing to rebury at the end of the test. The control sediment has a performance standard of 10 percent mortality. The reference sediment has a performance standard of 20 percent mortality greater than control.

6.3.2 Sediment Larval Bioassay. The test organism will be selected in consultation with the testing lab and dredge material management office (DMMO). Initial counts will be made for a minimum of five 10-ml aliquots. The test will be

run until the appropriate stage of development is achieved in a sacrificial seawater control (PSDDA MPR-Phase II, pp. 5-10). Aeration will be conducted throughout the test to minimize effects from hydrogen sulfide and ammonia. At the end of the test, larvae from each test sediment exposure will be examined to quantify abnormality and mortality. Final counts for seawater control, reference sediment and test sediment will be made on 10-ml aliquots.

The seawater control has a performance standard of 30 percent combined mortality and abnormality. The reference sediment has a performance standard of 35 percent combined mortality and abnormality normalized to seawater control.

6.3.3 Neanthes Growth Test. *Neanthes arenaceodentata* takes 2 – 3 weeks to culture and deliver, test organisms will be obtained early enough to begin testing with a minimum delay as possible after notification that tests will be conducted.

The control sediment has a performance standard of 10 percent mortality. The reference sediment has performance standards of 20 percent mortality and 80 percent of the control growth rate.

6.4 Interpretation. Test interpretations consist of endpoint comparisons to control and reference on an absolute percentage basis as well as statistical comparison to reference. Test interpretation will follow the guidelines established in the PSDDA Management Report-Phase II (page 5-17) for the amphipods and sediment larval bioassays, and the minutes of the dredging year 1991 annual review meeting for the *Neanthes* bioassay, as modified by subsequent annual review proceedings and workshops.

6.5 Bioassay Retest. Any bioassay retests must be fully coordinated with, and approved by, the DMMO.

6.6 Laboratory Written Report. The biological laboratory documenting all the activities associated with sample analyses will prepare a written report. As a minimum, the following will be included in the report:

- Results of the laboratory bioassay analyses and QA/QC results.
- All protocols used during analyses and any deviation from the approved sampling plan.
- Chain of custody procedures, including explanation of any deviation from the identified protocols.
- Location and availability of data, laboratory notebooks and chain-of-custody forms.

As appropriate, this sampling plan may be referenced in describing protocols.

Figure 2, Port of Astoria, East Boat Basin, Breakwater Repair Project
Bioassay Samples & Reference Sample